DATA PLAYBACK APPARATUS

FIELD OF THE INVENTION

The present invention relates to a data playback apparatus for reading data from a memory containing media data such as video and audio which has been compressed according to a compression coding method such as MPEG, and decoding and playing the data.

BACKGROUND OF THE INVENTION

In recent years, with advances in the compression coding technology for media data such as video and audio, techniques for manufacturing optical disks and magnetic disks and recording/playback techniques, it has become possible to record the media data of several hours on the optical disk or magnetic disk, and play back the same. In the case of DVD (Digital Video Disc, or also called Digital Versatile Disc) which is now rapidly coming into wide use, a movie of about two hours can be recorded on an optical disk, using MPEG2 or the like as the compression coding method, and played back. In addition, it is expected that a DVD recorder having functions which are equivalent to those of a present VCR (Video Cassette Recorder) and are realized by an optical disk will be shortly brought out. Hereinafter, a data structure in the DVD recorder as a prior art of the data playback apparatus and the operation of the recorder will be described.

Figures 11(a)-11(c) are schematic diagrams for explaining a data structure in the DVD recorder (see "DVD Specifications for Rewritable/Re-recordable Discs Part3 VIDEO RECORDING Version1.0, September 1999").

Figure 11(a) shows an entire data structure in a DVD, which is composed of a DVD_RTAV folder 1101, a management data file 1102, a movie data file 1103, a still-picture data file 1104, and audio data file 1105. The DVD_RTAV is a folder which contains the files 1102~1105. The management data file 1102 includes entire information of the DVD such as the title text and updated date, and information concerning each program included in the DVD. Here, the program is one playback unit, i.e., a broadcast program. For example, news, a baseball relay broadcast, a movie and the like are programs, respectively. The management data file includes the title, creation date, playback duration, start address of the movie data file and the like, as information concerning each of the programs. The movie data file 1103 is a file which is obtained by concatenating plural programs. One example thereof is shown in figure 11(b). In this example, the movie data file is composed of three programs, i.e., a first program 11031, a second program 11032 and a third program 11033. In the movie data file, as shown in figure 11(c), compressively coded data of audio and video are multiplexed in units referred to as "PACK".

The size of a pack in the DVD recorder is fixed at 2048 bytes. In the still-picture data file 1104, plural pieces of compressively coded still-picture data are multiplexed in units of pack. This is used as data for a slide show in which display images are switched at prescribed periods. In the audio data file 1105, compressively coded audio data are multiplexed similarly in units of pack. This is for use on the postrecording to movie data.

Figure 12 is a diagram for explaining an example of program playback when the second program 11032 shown in figure 11(b) is to be played. Address information for indicating from which byte in the movie data file 1103 the playback is to be started is recorded in the management data file 1102, for each program. Therefore, when the second program 11032 is to be played, start address information 1201 of the second program is initially extracted from the management data file 1102 and, in accordance with this start address information, the reading position of the movie data file 1103 is moved to a position indicated by the information. Then, the data are read out, whereby the playback can be started from the second program.

In order to perform high-seed searching playback of a program or program searching playback, information of reading positions in the movie data file at intervals of about one second is included in the management data.

Next, the program erasure in the DVD recorder is described with reference to figure 13. In figure 13, numeral 1103 denotes a movie data file before program erasure, which is composed of three programs in this case. Assuming now that the second program 11032 is to be erased, the third program 11033 is concatenated immediately after the first program 11031, as shown by numeral 1303. Simultaneously, the information concerning the second program 11032 is also erased from the management data file.

In the above descriptions, the outlines of the data structure in the DVD recorder and the operation for playing or erasing a program are given.

As described above, in the DVD recorder as the prior art data playback apparatus, the media data such as video and audio are recorded as a movie data file in which plural programs are concatenated. The object to concatenate plural programs as one file is to make the best use of the capacity of a disc. However, in this data structure, following problems occur.

Initially, it is required to extract start addresses of all programs to decide reading positions of the movie data file in the management data file, whereby the structure of the data playback apparatus is complicated. Further, when the number of programs is increased, there is a risk that the size of management data becomes enormous due to

the start address information. In portable information terminals using MPEG4 as the latest media data compression coding technology, the coding bit rate of media data is assumed to be approximately 64~384 Kb/sec., which is some-tenths as large as the coding bit rate of a DVD using MPEG2, or smaller. Further, in the portable information terminals, it is assumed to obtain media data by radio communication. It is expected that the playback time of one program becomes relatively short, for example, approximately some dozen seconds to some minutes, to suppress the communication charges. Therefore, there is a possibility that the number of programs recorded on one disc is substantially increased.

In addition, on the erasure of a program, a process of concatenating unerased programs to recreate a movie data file is required. Since the portable information terminal uses a secondary battery such as a lithium ion, the above-mentioned program concatenation/recreation processing reduces the utilization time at one charge, thereby decreasing the user's operability.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a data playback apparatus which improves a file structure and carries out a processing in accordance with the file structure.

Other objects and advantages of the present invention will become apparent from the detailed description and specific embodiments described are provided only for illustration since various additions and modifications within the spirit and scope of the invention will be apparent to those of skill in the art from the detailed description.

Therefore, the start address information of each program in the management data is dispensed with, thereby facilitating the access in program units. Consequently, the structure of the data playback apparatus can be simplified.

A data playback apparatus according to a 1st aspect of the present invention comprises: a memory which has at least one program data folder each containing a program composed of compressively coded data including at least one video data file, and a management data folder containing management data which include information each indicating attribute information, a playback duration, and title information concerning each program; a decoding unit for selecting at least one program data folder with referring to the management data on the basis of playback instruction data which are information concerning an instruction of playback of a program, input from outside the apparatus, reading compressively coded data which are stored in the selected program data folder, decoding the same, and

outputting decoded data; and a display unit for displaying the decoded data. Therefore, the start address information for each program in the management data is dispensed with, whereby the access in units of a program can be facilitated. Consequently, the structure of the data playback apparatus can be simplified.

According to a 2nd aspect of the present invention, in the data playback apparatus of the 1st aspect, a decryption unit is included between the memory and the decoding unit, at least part of the compressively coded data is encrypted, the decoding unit requests compressively coded data from the decryption unit, and the decryption unit reads the requested compressively coded data from the memory, carries out decryption, and outputs decrypted compressively coded data to the decoding unit. Therefore, a program which includes media data which have been encrypted and stored in the memory can be played.

According to a 3rd aspect of the present invention, in the data playback apparatus of the 1st aspect, the management data include information indicating the number of the program data folders, and information concerning each program data folder, the number of which information is equal to the number of the program data folders. Therefore, the number of programs stored in the memory can be easily obtained and further the information depending on the

program can be obtained collectively.

According to a 4th aspect of the present invention, in the data playback apparatus of the 3rd aspect, the decoding unit, on the basis of erasure instruction data input from outside the apparatus, which are information concerning an instruction of erasure of a program, erases the program data folder and data in the program data folder, as well as generates new management data in which the information indicating the number of the program data folders has been updated and the information concerning the program data folder to be erased has been eliminated, and replaces the management data stored in the management data folder with the generated management data. Therefore, the program concatenation processing on the program erasure can be dispensed with, the loads on the data playback apparatus can be reduced, and further the relationship between the management data and the program data folder can be always retained accurately.

According to a 5th aspect of the present invention, in the data playback apparatus of the 1st aspect, the program data folder contains playback control data which are information concerning a control of playback of a program stored in the program data folder itself, and the decoding unit reads the compressively coded data on the basis of the playback control data and decodes the coded data. Therefore,

the playback control data and the media data can be collectively erased on the erasure of the program data folder, and consequently the structure of the data playback apparatus can be simplified.

According to a 6th aspect of the present invention, in the data playback apparatus of the 1st aspect, the management data include data protection information which is information concerning permission or inhibition of erasure of each program data folder and data in the program data folder, and the decoding unit receives erasure instruction data which are information concerning an instruction of erasure of a program, from outside the apparatus, and erases a program data folder indicated by the erasure instruction data and data in the program data folder when the data protection information for the program data folder indicated by the erasure instruction data and the data in the program data folder shows the permission of erasure. Therefore, an erroneous erasure of the program by the user can be prevented.

According to a 7th aspect of the present invention, the data playback apparatus of the 1st aspect comprises: an access information storage unit for reading/writing at least one of number-of-access information indicating the number of times that a program was played and latest access date/time information indicating a latest time when the

program was played, from/onto the memory; and a chart creation unit for creating a chart by rearranging program data folders on the basis of one of the number-of-access information and the latest access date/time information, and outputting the same to the display unit. Therefore, the user can easily select the frequently accessed program, and further when the stored program is erased from the memory, the one having a lower number of accesses or the one which has not been accessed recently is displayed with priority, thereby facilitating the selection of the program to be erased.

According to an 8th aspect of the present invention, in the data playback apparatus of the 1st aspect, the memory is removable. Therefore, the program previously stored by another apparatus can be played.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram illustrating a structure of a data playback apparatus according to a first embodiment of the present invention.

Figure 2 is a schematic diagram for explaining a structure of a file stored in a memory of the data playback apparatus of the first embodiment.

Figures 3(a) and 3(b) are schematic diagrams for explaining structures of a program management information file stored in a memory of the data playback apparatus of

the first embodiment.

Figure 4 is a flowchart for explaining an operation of a decoding means of the data playback apparatus of the first embodiment.

Figure 5 is a flowchart for explaining a program playback process of the decoding means of the data playback apparatus of the first embodiment.

Figure 6 is a flowchart for explaining a program erasure process of the decoding means of the data playback apparatus of the first embodiment.

Figure 7 is a block diagram illustrating a structure of a data playback apparatus according to a second embodiment of the present invention.

Figure 8 is a block diagram illustrating a structure of a data playback apparatus according to a second embodiment of the present invention.

Figure 9 is a block diagram illustrating a structure of a data playback apparatus according to a third embodiment of the present invention.

Figure 10 is a diagram showing an example of access information and an example of a chart in the data playback apparatus of the third embodiment.

Figure 11(a)-11(c) are schematic diagrams for explaining structures of files stored in a memory of a prior art data playback apparatus.

Figure 12 is a schematic diagram for explaining a program playback process of the prior art data playback apparatus.

Figure 13 is a schematic diagram for explaining a program erasure process of the prior art data playback apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[Embodiment 1]

A data playback apparatus according to the first embodiment of the present invention will be described. In this first embodiment, compressively coded media data such as audio and video recorded in a memory are stored as movie data files in their respective program data folders. In addition, information such as the tile of each program and the number of contained media data is stored as management data in a management data folder. The movie data file of each program data folder is decoded/played in accordance with the information of the management data. Further, the erasure of the movie data file is performed in program units. When the file is divided in program units, the management of start address information of each program and the concatenation process for data files in the program erasure and the like, required by the prior art DVD recorder, are omitted in the data playback apparatus, whereby the structure of the apparatus is simplified. Hereinafter, the

description is given with reference to the drawings.

Figure 1 is a block diagram illustrating a structure of the data playback apparatus. The data playback apparatus 101 comprises a memory 102 for containing compressively coded media data and management data, a decoding means 103 for receiving a playback instruction signal/erasure instruction signal, receiving the media data in accordance with the management data stored in the memory, and decoding the media data, and a display means 104 for displaying the decoded media data.

Figure 2 is a diagram for explaining the contents stored in the memory. Assume that circles show folders and rectangles show files, respectively. The memory includes a route folder SDV 201 and, directly under this folder, a management data folder MGR_INFO (202) and program data folders PRG001~PRGxxx (203~205) are stored. In the management data folder 202, an entirety identification data file 206 including title information of the entire SDV and the like, and a program management data file 207 including the total number of programs and title information of each program and the like are stored. Movie data files 1 and 2 (208 and 209) are stored in the first program data folder PRG001, movie data files 3~5 (210~212) are stored in the second program data folder PRG002, and a movie data file X (213) are stored in the N-th program data folder PRGxxx.

Figures 3(a) and 3(b) are diagrams for explaining the contents of the program management data file 207. Figure 3(a) shows entire program management data, in which the total number 301 of programs stored in the memory and information 302~304 concerning the respective programs and the like are recorded. Figure 3(b) shows contents of the information concerning each program, in which the data ID 305, the data size 306, the program ID 307, the program attribute 308, the total number 309 of movie data files, movie data file IDs 310~312 and the like are recorded.

Figures 4 to 6 are flowcharts for explaining the program playback process and the program erasure process in the decoding means 103 shown in figure 1.

Hereinafter, the program playback process in the data playback apparatus according to the first embodiment is described, initially with reference to figures 1 to 5.

Initially, in step S401, the decoding means reads the program management data from the memory. This step is carried out, for example, immediately after the starting switch of the data playback apparatus is turned on. Next, in step S402, the decoding means enters the instruction signal input waiting state. Though not shown in figure 1, the instruction signal is input to the decoding means through the user interface of the data playback apparatus. When the instruction signal is input, the contents of the

instruction signal are analyzes in steps S403 and S404. When the instruction signal is a program playback instruction signal (step S403), the process proceeds to a program playback process in step S405. On the other hand, when the instruction signal is a program erasure instruction signal (step S404), the process proceeds to a program erasure process in step S406.

Figure 5 is a flowchart for explaining details of the program playback process (step S405). Initially, in step S501, a program ID (Gn) for an instructed program "n" is generated.

The program ID generation method is previously programmed in the data decoding means. The ID is one for identifying a program data folder or movie data file in the program management data, and corresponds to the program data folder or movie data file in the memory in a one-to-one relationship. Since the ID is generated on the basis of the combination of the program data folder and the movie data file, even if there are the same movie data file names, when their program data files are different from each other, the IDs are not the same. The ID can be for example an integer of 32 bits. The most significant 8 bits are for use on identification of either a folder or a file. The following 12 bits indicate a program data folder number. The least significant 12 bits indicate a movie data file number in

the case where the ID shows a file.

Next, in step S502, a program ID which matches the program ID generated in step S501 is retrieved from the management data which are read in step S401. The information concerning each program contains the program ID, as shown in figure 3(b) by numeral 307. Program information having this program ID which matches the generated program ID is information concerning the program to be played.

Then, in step S503, variables i and M are prepared, and zero and the total number of the movie data files are set as the initial values, respectively. The total number of the movie data files is stored in the information concerning the program, as shown in figure 3(b) by numeral 309.

In step S504, the variables i and M are compared each other, and when the variable i is smaller than the variable M, the process proceeds to step S505. On the other hand, when the variable i is equal to or larger than the variable M, the data playback process is finished, and the decoding means returns to the instruction signal input waiting state of step S402. Now, a description is given as an example of a case where the playback of PRG001 as the first program 203 in figure 2 is instructed. PRG001 contains two movie data files 208 and 209. Therefore, the total number of the

movie data files is recorded as "2", and the variable M is set at "2".

Next, in step S505, the first movie data file 208 is read, and then the media data such as compressively coded video and audio included in the file are successively decoded and output. The display means 104 displays these data. In this case, the two movie data files are played according to the order in which the movie data file IDs are arranged in figure 3(b).

When the reading and decoding of the first movie data file is finished, "1" is immediately added to the variable i in step S506, and then the process returns to step 504 to compare the variables i and M. Since the variable M is "2" and the variable i is "1" now, because "1" has been added thereto, the process proceeds to step S505 and the second movie data file is read and decoded similarly.

When the reading and decoding of the second movie data file is finished, "1" is immediately added to the variable i in step S506 and then the process returns to step S505 to compare the variables i and M. Since the variable M is "2" and the variable i is "2" now, the condition of step S504 does not stand and the process is finished.

Next, the program erasure process in the data playback apparatus according to the first embodiment is described with reference to figure 6.

Initially, in step S601, a program ID (Gn) for an instructed program "n" is generated. This program ID is generated on the basis of the ID generation method as that described in step S501.

Next, in step 602, a program ID which matches the program ID generated in step S601 is retrieved from the management data which are read in step 401. The information concerning each program contains the program ID, as shown in figure 3(b) by numeral 307. Program information having this program ID which matches the generated program ID is information concerning the program to be erased.

Then, in step 603, the program attribute 308 shown in figure 3(b) is examined. The program attribute contains a protection flag indicating that the program is protected. When the protection flag is true, it is assumed that the program is protected and the erasure is inhibited. In this case, the condition of step S603 does not stand, and then the process is finished. That is, the erasure process is not carried out.

When the protection flag is false, in step S604, the program information concerning the program "n" is eliminated from the read-in program management data, then "1" is subtracted from the value of the total number 301 of programs, and the resultant is replaced with the management data in the memory.

Then, in step 605, all files included in the folder of the program "n" are erased from the memory, and then the program data folder "n" is also erased from the memory.

In figure 1, the memory can have an installable/ removable structure. With this structure, a program which is previously recorded by another apparatus can be easily played.

In this first embodiment, the program data folders and the movie data files are identified by the IDs in the program management data file. However, the program data folder names and the movie data file names can be recorded in place of the IDs.

In this first embodiment, the management data are stored in the management data folder MGR_INFO 202 shown in figure 2. However, the management data can be stored directly under the SDV 201 and the management data folder can be omitted.

In addition, in this first embodiment, the program management data file contains the information concerning all programs. However, the information concerning each program as shown in figure 3(b) can be stored separately in each program data folder.

Further, in addition to the movie data file, a playback control file for each movie data file can be stored as data which are stored in the program data folder. For example,

playback start addresses of a movie data file at intervals of one second are recorded in the playback control file. When only video frame data at every one second are decoded by the decoding means 103 to perform high-speed playback, data of one video frame is successively read from the playback start address of the movie data file to be decoded, by using the playback control file, whereby the high-speed playback is realized. Further, even when the user designates a playback start time in the program, the jump position can be also decided at high speed by using the playback control file. Further, the playback control data is not limited to files other than the movie data file, but this can have a file structure in which playback control data are multiplexed at the head or rearmost position of the movie data file.

In this first embodiment, the file which is obtained by multiplexing compressively coded audio or video data is described as the movie data file. However, even files including compressively coded still pictures, text data and the like can be also processed by the data playback apparatus 101 of the first embodiment.

Further, in this first embodiment, the data playback apparatus 101 is realized by hardware. However, the decoding means 103 of the data playback apparatus 101 can be realized by software. For example, the decoding means

can be also realized in a computer system by using a software program which is programmed such that the processes in the decoding means 103 shown in figures 4 to 6 are carried out by a CPU (Central Processing Unit). Even when the data playback apparatus 101 of the first embodiment is realized by this software, the same effects as those in the first embodiment can be obtained. The above-mentioned software program can be stored in a storage medium such as a floppy disk, an optical disk, a magnetic disk, an IC card, and a ROM cassette.

[Embodiment 2]

A data playback apparatus according to the second embodiment of the present invention will be described with reference to figure 7. Figure 7 is a block diagram illustrating a structure of the data playback apparatus 701 of the second embodiment. The difference of the data playback apparatus 701 from the data playback apparatus of the first embodiment is that a decoding means 704 carries out reading of the media data via a decryption means 703. An encryption process is carried for at least part of the movie data files stored in a memory. The decryption means 703 outputs a movie data file which is obtained by decrypting an encrypted part of a movie data file read from the memory, as a movie data file requested by the decoding means 704 through the processes of the first embodiment.

The structure of a memory 702, the processing of the decoding means 704, and the processing of a display means 705 are the same as those in the data playback apparatus according to the first embodiment.

In this second embodiment, the decryption means 703 is between the memory 702 and the decoding means 704, and the decoding means 704 requests a movie data file from the decryption means 703. However, for example like a data playback apparatus 801 as shown in figure 8, a decoding means 804 can carry out the processing by reading an encrypted movie data file from a memory 802, thereafter outputting the encrypted movie data file to a decryption means 803, and inputting the movie data file which has been decrypted by the decryption means 803.

[Embodiment 3]

Figure 9 is a block diagram illustrating a data playback apparatus according to the third embodiment of the present invention.

As shown in figure 9, the data playback apparatus 901 of the third embodiment comprises a memory 902 for containing compressively coded media data and management data, a decoding means 903 for receiving a playback instruction signal/erasure instruction signal, receiving the media data in accordance with the management data stored in the memory 902, and decoding the media data, a display

means 904 for displaying the decoded media data, an access information storage means 905 for reading/writing number-of-access information indicating the number of times that a program was played and latest access date/time information indicating the latest time when the program was played, from/onto the memory 902 as access information data, and a chart creation means 906 for creating a chart by rearranging program data folders on the basis of the number-of access information, and outputting the chart to the display means 904.

Hereinafter, the operation of the data playback apparatus of the third embodiment for creating the chart is described.

Figure 10 is a diagram showing an example of the access information and an example of the chart in the data playback apparatus of the third embodiment.

The access information storage means 905 writes the number-of-access information indicating the number of times that the program was played and the latest access data/time information indicating the latest time when the program was played, onto the memory 902 as the access information data, in accordance with the playback instruction signal and time information which are input from outside of the apparatus.

When a chart creation instruction signal is input from outside of the apparatus to the chart creation means 906,

the access information storage means 905 reads the number-of-access information from the memory 902 and outputs the information to the chart creation means 906.

The chart creation means 906 receives the number-of-access information output by the access information storage means 905 and the management read from the memory 902, respectively, and creates the program chart on the basis of the number-of-access information by rearranging the programs in order of the descending number of accesses, to output the chart to the display means 904.

As described above, the data playback apparatus of the third embodiment displays the chart of programs rearranged in order of the descending number of accesses. Therefore, even in such a miniature playback terminal that the displayable number of characters or number of lines is limited and accordingly the number of titles of programs which can be displayed at a time is limited, the user can easily select a frequently accessed program. Also when an already stored program is to be erased from the memory, the one having a smaller number of accesses is displayed with priority, whereby the selection of a program to be erased can be easily performed.

In this third embodiment, the chart creation means creates the chart by rearranging the program data folders on the basis of the number-of-access information. However,

the chart creation means can also create the chart by rearranging the program data folders on the basis of the latest access data/time information.

Further in this third embodiment, the program ID and the number of accesses are displayed, while the title information and the like of each program included in the management data can be displayed.

Further, the access information can be stored as part of the management data, or stored in the management data folder as another folder. Or, it can be stored as one of files in each program data folder.